South and Latin America Data Mining Analysis Project
Executive Summary

For

Office of Naval Research International Liaison Office

Submitted By:

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Background

The Office of Naval Research (ONR) has the desire to expand its global Science and Technology (S&T) reach by opening an International Field Office (IFO) in the South or Latin American (S/LA) region. The objective of this effort was to conduct a data mining analysis of published technical papers to identify key S&T "Centers of Excellence" and technical points of contact in the S/LA region as a prelude to selecting a potential IFO site.

Approach

Working for the ONR International Liaison Office (ONRILO), a data mining team of Naval Reservists and a consultant was assembled. *Argentina, Brazil, Chile, and Mexico* were identified by ONR as countries having economies large enough to support significant levels of R&D and were the focus of this study. An internal ONR review identified the following technology areas to be examined in this study:

- Materials Science
- Bio-science
- Naval Architecture
- Human Factors
- Electronics/Computer Science/Radar
- Underwater Acoustics
- Optics
- Manufacturing
- Oceanography

Data was obtained from on-line literature database vendors and analyzed using data mining software called TechOASIS™ produced by Search Technologies, Inc., Norcross, GA, which uses statistical algorithms to analyze and sort large amounts of data into usable forms. Depending on the particular technology area, one or more of the specific databases employed in this study were *Science Citation Index* (SCI*), Inspec*, and *EI-Compendex*. With the exception of underwater acoustics, data was collected and analyzed for the period between 1997 and 2001. The analytical methodology followed in the study was comprised of a three-step process, which consisted of:

1) Gathering data records from the databases using keywords which focused on the technology of interest,
2) Importing and analyzing these records using TechOASIS, and
3) Reviewing and formatting the data using Microsoft Excel and Microsoft Word.

The general results of this effort is illustrated below:

Total Publications by Technology Area

7040
3824
2536
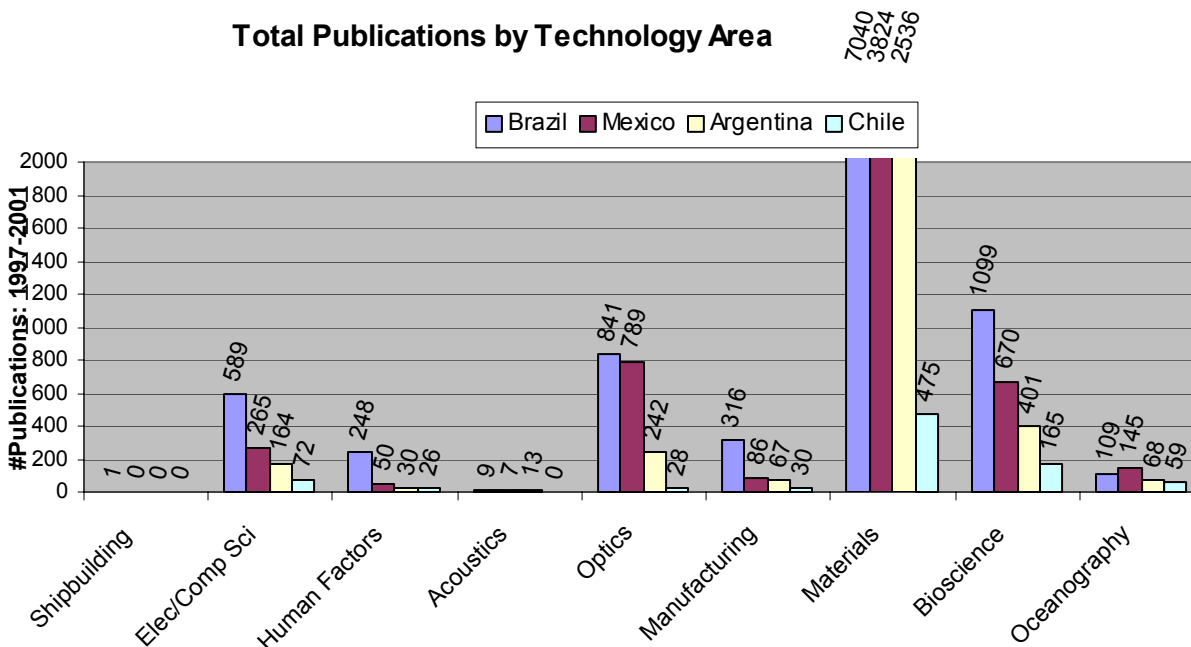
By far the most significant technology that stands out from this study is in the materials science area, followed by the biosciences and optics. The end product of this effort was a list of the most prolific authors and institutions performing work in each of the selected technology areas. The following sections of this Executive Summary highlight the results of this study. A "lesson's learned" summary is included at the end as a helpful reference for subsequent data mining efforts. The team presented a detailed Microsoft PowerPoint™ presentation of the results at ONRHQ, Arlington, VA on 8 February 2002 to the staff at ONRILO and ONRIFO (via video teleconference). This presentation can be referred to for more detail as desired.

Material Science

Approach

The material science capability in the Latin American countries of Argentina, Brazil, Chile, and Mexico was investigated by analyzing citation information from both the INSPEC and SCI databases. For INSPEC analysis, citations were retrieved using the INSPEC classification code system, specifically codes A6 Condensed Matter, Thermal and Electric, A7 Condensed Matter, Electronic, Electrical, Magnetic, and Optical, and A81 Materials Science. For SCI, citations were retrieved using the following key words: mechanical properties, thermal properties, acoustic properties, surfaces, interfaces, electronic properties, magnetic properties, optical properties, and material science. Authors and institutions were ranked by number of publications.

Results

Argentina:

Top five authors in Argentina from the INSPEC and SCI databases

INSPEC		SCI	
Author		**Author**	
Aligia-AA	Centro Atomico Bariloche,	Salvarezza, RC	Natl Univ La Plata
Nieva-G	Centro Atomico Bariloche	Arvia, AJ	Natl Univ La Plata
Rodriguez-CO	Grupo de Fisica del Solido, IFLYSIB, La Plata	Albano, EV	Natl Univ La Plata
de-la-Cruz-FP	Centro Atomico Bariloche	Nieto, FJR	Univ Nacl San Luis
Albano-EV	Inst. de Investigaciones Fisicoquimicas Teoricas y Aplicadas, La Plata	Uebing, C	Univ Nacl San Luis

Top five institutions in Argentina from the INSPEC and SCI databases

INSPEC	SCI
Universidad Nacional de La Plata	Universidad de Buenos Aires (UBA)
U.A. Mater., Centro Atomico Constituyentes, Comision Nacional de Energia Atomica, Buenos Aires, Argentina	Universidad Nacional de La Plata
Grupo de Fisica Estadistica, Centro Atomico Bariloche, Rio Negro, Argentina	Comis Nacl Energia Atom
Universidad de Buenos Aires (UBA)	Universidad Nacional de Córdoba
Universidad Nacional de Córdoba	Univ Natl San Luis

Brazil:

Top five authors in Brazil from the INSPEC and SCI databases

INSPEC		SCI	
Author		**Author**	
Longo-E	Univ. Fed. de Sao Carlos, Brazil	Farias, GA	Univ Fed Ceara
Varela-JA	Univ. Fed. de Sao Carlos, Brazil	Freire, VN	Univ Fed Ceara
Leite-JR	Sao Paulo Univ., Brazil	Baesso, ML	Univ Estadual Maringa
Leite-ER	Univ. Fed. de Sao Carlos, Brazil	Knobel, M	Univ Estadual Campinas
Baggio-Saitovitch-EM	Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil	Miranda, LCM	Univ Estadual Maringa

Top five institutions in Brazil from the INSPEC and SCI databases

INSPEC	SCI
Universidade Estadual Paulista	Univ Western Sao Paulo
Universidade Federal do Rio Grande do Sul	Univ Fed Rural Rio de Janeiro
Universidade Federal de Minas Gerais	University of Campinas
Universidade Federal do Rio de Janeiro	Univ Sao Carlos
Univ. Fed. de Sao Carlos, Brazil	Universidade Federal do Rio Grande do Sul

Chile:

Top five authors in Chile from the INSPEC and SCI databases

INSPEC		SCI	
Author		**Author**	
Mujica-C	Dept. de Quimica, Univ. Catolica del Norte	Garland, MT	Univ Chile
Vargas-P	Dept. de Fisica, Chile Univ.	Spodine, E	Univ Chile
Vogel-EE	Dept. of Phys., Univ. de La Frontera	Baggio, RF	Univ Chile
Fuenzalida-VM	Fac. de Fisica, Pontificia Univ. Catolica de Chile	Gutierrez, FA	Concepcion Univ
Peters-K	Dept. de Quimica, Univ. Catolica del Norte	Kiwi, M	Pontificia Univ Catolica Chile

Top five institutions in Chile from the INSPEC and SCI databases

INSPEC	SCI
Pontificia Universidad Católica de Chile	Universidad de Chile
Fac. de Fisica, Univ. Catolica de Chile	Universidad de Concepción
Universidad Católica del Norte	Pontificia Universidad Católica de Chile
Universidad de Santiago de Chile	Universidad de Santiago de Chile
Universidad de La Frontera	European So Observ

Mexico:

Top five authors in Mexico from the INSPEC and SCI databases

INSPEC		SCI	
Author		**Author**	
Gonzalez-Hernandez-J	Centro de Investigacion en Ciencia Aplicada y Tecnologia Avanzada, I.P.N.	Mendez, ER	Ctr Invest Cientifica & Educ Super Ensenada
Zelaya-Angel-O	Dept. de Fisica, CINVESTAV-IPN	Mendoza, BS	Ctr Invest Opt
Sebastian-PJ	Centro de Investigaciones en Energia, UNAM	Gonzalez-Hernandez, J	IPN, Ctr Invest & Estudios Avanzados
Ramirez-Bon-R	Centro de Investigacion en Fisica, Sonora Univ.	Castano, VM	UNAM
Pizio-O	Inst. de Quimica, Univ. Nacional Autonoma de Mexico	Mirabal-Garcia, M	UNAM

Top five institutions in Mexico from the INSPEC and SCI databases

INSPEC	SCI
Universidad Nacional Autonoma de Mexico	Universidad Nacional Autonoma de Mexico
Universidad Autonoma Metropolitana	Instituto Politecnico Nacional
Instituto Politecnico Nacional	Universidad Autonoma Metropolitana
Inst. de Metalurgia, Univ. Autonoma de San Luis Potosi, Mexico	Univ Autonoma Puebla
Plasma Phys. Lab., Inst. Nacional de Investigaciones Nucl., Mexico City, Mexico	Univ San Luis Potosi

Recommendations

Based on number of publications, the R&D capability in material science is largest in Brazil, followed by Mexico, Argentina, and Chile respectively. In all four countries, the most significant amount of work is being performed in the areas of superconductivity, electronic materials, and magnetic materials. Significant research programs also exist in Argentina in electrochemistry and surfaces and interfaces, in Chile in crystal structure, and in Mexico in composite materials. Institutions of note in Argentina are the Centro Atomico Bariloche and the Natl Univ La Plata; in Brazil the Univ Fed Sao Carlos, Univ Sao Paulo, and Univ Estadual Campinas; in Chile the Univ Chile; and in Mexico the Instituto Politecnico Nacional and UNAM.

BioScience

Approach

The bioscience capability in the Latin American countries of Argentina, Brazil, Chile, and Mexico was investigated by analyzing citation information from both the INSPEC and SCI databases. . Records of the INSPEC and SCI databases were searched in the years 1997-2001. For INSPEC analysis, citations were retrieved using the INSPEC classification code system, specifically code A87 Classification Code: Biophysics, medical physics, and biomedical engineering. For SCI, citations were retrieved using the following key words: biotechnology, biorobotics, molecular biology, biological systems, and biomaterials. Authors and institutions were ranked by number of publications.

Results

Argentina:

Top authors in Argentina from the INSPEC and SCI databases

INSPEC		SCI	
Author		**Author**	
Fernandez-A	Univ. Nacional del Sur	Bernardello, G	Univ Nacl Cordoba
Enriz-RD	Univ. Nacional de San Luis	Galetto, L	Inst Multidisciplinario Biol Vegetal, Casilla Correo
Valentinuzzi-ME	Univ. Nacional de Tucuman	Medan, D	Univ Buenos Aires
Plastino-AR	La Plata Univ		
Suvire-FD	Univ. Nacional de San Luis		

Top institutions in Argentina from the INSPEC and SCI databases

INSPEC	SCI
Univ. Nacional de La Plata	Univ Buenos Aires
Univ. Nacional del Sur	CONICET
Buenos Aires Univ.	Univ Nacl Mar del Plata
Univ. Nacional de San Luis	Univ Nacl Cordoba
Univ. Nacional de Tucuman	

Brazil:

Top authors in Brazil from the INSPEC and SCI databases

INSPEC		SCI	
Author		**Author**	
Furuie-SS	InCor-Sao Paulo Heart Inst	Pandey, A	Univ Fed Parana
Lopes-RT	Univ. do Estado do Rio de Janeiro	Soccol, CR	Univ Fed Parana
Nadal-J	Fed. Univ. of Rio de Janeiro	Nigam, P	Univ Fed Parana
Gutierrez-MA	Heart Inst., Sao Paulo Univ	Fransozo, A	UNESP, Sao Paulo
Baffa-O	Sao Paulo Univ.		

Top institutions in Brazil from the INSPEC and SCI databases

INSPEC	SCI
Sao Paulo Univ.	Univ Sao Paulo
Polytech.. Inst. of Rio de Janeiro	Univ Rio de Janeiro
Catholic Univ. do Rio Grande do Sul	Univ Estadual Campinas
	UNESP

Chile:

Top authors in Chile from the INSPEC and SCI databases

INSPEC		SCI	
Author		**Author**	
Perez-CA	Chile Univ.	Thiel, M	Univ Catolica Norte
Holzmann-CA	Chile Univ.	Wehrtmann, IS	Univ Austral Chile
Guarini-M	Catholic Univ. of Chile	Lardies, MA	Univ Austral Chile
Cipriano-A	Catholic Univ. of Chile	Contreras, H	Univ Austral Chile
Urzua-J	Catholic Univ. of Chile		

Top institutions in Chile from the INSPEC and SCI databases

INSPEC	SCI
Dept. of Electr. Eng., Pontificia Univ. Catolica de Chile	Univ Chile
Fac. de Med., Pontificia Univ. Catolica de Chile	Univ Catolica Chile
Dept. de Quimica, Chile Univ., Santiago	Univ Austral Chile
Inst. of Biomed. Sci., Chile Univ.	Concepcion Univ
Dept. de Biol. Molecular, Univ. de Concepcion	

Mexico:

Top authors in Mexico from the INSPEC and SCI databases

INSPEC		SCI	
Author		**Author**	
Brandan-ME	Univ. Nacional Autonoma de Mexico	Gamba, G	Inst Nacl Nutr Salvador Zubiran, Dept Nefrol & Metab Mineral, Unidad Fisiol Mol, Vasco Quiroga 15, Mexico City
Rodriguez-Villafuerte-M	Univ. Nacional Autonoma de Mexico	Collado-Vides, J	Univ Nacl Autonoma Mexico
Leija-L	IPN	Mayani, H	IMSS, Natl Med Ctr, Bernardo Sepulveda Hosp
Medina-VB	Univ. Autonoma Metropolitana	Valiente-Banuet, A	Univ Nacl Autonoma Mexico
Gamboa-deBuen-I	Univ. Nacional Autonoma de Mexico		

Top institutions in Mexico from the INSPEC and SCI databases

INSPEC	SCI
Univ. Autonoma Metropolitana	Univ Nacl Autonoma Mexico
Inst. Nacional de Investigaciones Nucl.	IPN
Univ. Autonoma Metropolitana	Inst Nacl Nutr Salvador Zubiran
Dept. Ing. Electr., CINVESTAV-IPN	IMSS
Dept. of Physiol, IPN	

Recommendations

Based on number of publications, the R&D capability in bioscience is largest in Brazil, followed by Mexico, Argentina, and Chile respectively. Significant research programs exist in Argentina in the areas of medical signal processing, evolution, and reproductive biology with the capability located at the Univ. Nacional de Tucuman, Natl. Univ. of La Plata and the Univ Nacl Cordoba;. Programs in Brazil are strong in the areas of medical signal processing, bioagriculture, and oceanography with the capability located at the Univ. of Rio de Janeiro, Sao Paulo Univ, Univ Fed Parana and Univ Estadual Paulista;. Significant capability in Chile exists in the areas of cardiac medicine and oceanography with the capability located at the Catholic Univ. of Chile, Univ Catolica Norte and the Univ Austral Chilew. In Mexico, significant capability exists in the areas of radiation dosimetry and molecular biology with the capability located at the Univ. Nacional Autonoma de Mexico.

Naval Architecture

Approach

The naval architecture capability in the Latin American countries of Argentina, Brazil, Chile, and Mexico was investigated by analyzing citation information from both the INSPEC and SCI databases. . Records of the INSPEC and SCI databases were searched in the years 1997-2001. For INSPEC and SCI analysis, citations were retrieved using the following key words: naval architecture, shipbuilding, and electric ship.

Results and Recommendations

Based on literature citations, significant R&D capability in shipbuilding does not exist in these Latin American countries. Consultations with experts at ONR and NSWC confirmed the lack of R&D and attributed it to both a dependence on European sources for R&D and on R&D being funded by corporate sponsors that do not publish the results.

Human Factors

Approach

An analysis has been performed to determine the science and technology S&T) expertise in the field of Human Factors in the countries of Argentina, Brazil, Chile, and Mexico. Records of the INSPEC and Ei-Compendex databases were searched. A total of 354 records related to human factors were uncovered. Author citations were cross-checked using the Science Citation Index. Key words used were: Decision Support, User Interface, Knowledge-Based, Cognitive Awareness, Cognitive Psychology, Cognitive Physiology, HCI, HSI, HMI, Human Factors, Virtual Reality, and Distance Learning.

Results

Argentina:
Argentina accounted for 8 percent of the dataset, 30 records out of 354 total. Most of the research was concentrated in the fields of decision support systems, computer simulation, virtual reality, graphical user interfaces and industrial management. Argentina's leading human factors authors/institutions are:

Chiotti (Facultad Regional Sante Fe) - Decision Support
Rossi (Univ. Nacional de la Plata) - Graphical User Interfaces
Rossi published less then Chiotti (6 to 9) but was cited more often (97 times to Chiotti's 64).

Brazil:
Brazil accounted for 70 percent of the dataset, 248 records out of 354 total; clearly the leader in South American human factors research. Most of their publishing effort was focused on decision support systems, computer simulation, virtual reality, math models and 3D computer graphics. Brazil's leading human factors authors/institutions are:

Kirner (Fed. Univ. Sao Carlos) - Virtual Reality and 3D
Nunes dos Santos (Univ Rio De Janeiro) - Virtual Reality
Sieckenius (Pontifical Catholic Univ, Rio de Janeiro) – Human Computer Interface
Velho (Inst de Matematica Pura e Aplicada, Rio de Janeiro) – Virtual Reality & Computer
        Simulation
Martins (Univ. Fed. De Santa Catarina, Florianapolis) - Decision Support Systems

Velho leads the citation count with 219 citations for eight publications. Martins follows with 43 citations for four articles and Kirner has 21 for six.

Chile:
Chile accounted for 7 percent of the dataset, 26 records out of 354 total. Research was concentrated on decision support systems, computer simulation, virtual reality and computer software. Chile's leading human factors authors/institutions are:

Nussbaum (Pontificia Univ. Catolica de Chile, Santiago) - Decision Support Systems
Sanchez (Chile Univ., Santiago) - Virtual Reality, Human Computer Interface

Nussbaum was extensively cited, 165 times for his nine published articles. No citation data was found for Sanchez' four articles.

Mexico:
Mexico accounted for 15 percent of the dataset, 50 records out of 354 total. Mexico is unique in that the most prolific human factors authors do not correspond with the most prolific institutions. Additionally, there did not appear to be any real focus in research areas; the 50 records covered a wide variety of topics and rarely duplicated descriptors. Virtual reality, mechanical manipulators, control systems and graphical user interfaces were the most listed descriptors but they had no more then four records per topic.

Mexico's leading human factors authors are:
Cardiel (Univ Michoacana de San Nicolas de Hidalgo) - Manipulators
Horta-Mejia (Centro Nacional Investigacion y Desarrollo Tecnologico, Mexico City) – Control Equipment
Favela (CICESE Research Center, Encenada) - WWW, Emotional Awareness

Mexico's leading human factors institutions are:
Univ. Nacional Autonoma de Mexico, Mexico City – eight publications
Institute Politecnico Nacional, Mexico City – four publications
Univ. de las Americas, Puebla – four publications

Cardiel and Horta-Mejia had no citation data available. Favela was cited 96 times for his four articles.

Recommendations

Visit recommendations are based, in part, on the absence or presence of citation information found in the Science Citation Index. By using citations as a cross-check, the visit list is narrowed down to the authors who are most recognized by their peers as subject matter experts. The following human factors authors and institutions are recommended to be visited by ONR representatives:

Argentina:
Decision Support, Virtual Reality
Chiotti - Facultad Regional Sante Fe
Rossi - Univ. Nacional de la Plata

Brazil:
Virtual Reality, 3D, Decision Support Systems
Kirner - Fed. Univ. Sao Carlo
Velho - Inst de Matematica Pura e Aplicada, Rio de Janeiro
Martins - Univ. Fed. De Santa Catarina, Florianapolis

Chile:
Decision Support, Virtual Reality, HCI
Nussbaum - Pontificia Univ. Catolica de Chile, Santiago
Sanchez - Chile Univ., Santiago

Mexico:
Control Equipment, WWW
Horta-Mejia - Centro Nacional Investigacion y Desarrollo Tecnologico, Mexico City
Favela - CICESE Research Center, Encenada

Additionally, due to relatively small size of dataset, if further human factors research is required, recommend increasing the scope of the search to include ergonomics, artificial intelligence and biometrics as keywords.

Electronics/Computer Science/Radar

Approach

For Electronics/Computer Science/Radar both INSPEC and SCI databases were searched using the NRL web access interface. Search keywords included 'electronics', 'communications', 'radar', 'sensing', 'computer science' and 'command and control'. Countries outside Latin America dominate all these areas of applied technology.

Results

Argentina:
Argentina and Mexico had similar numbers of publications in these technology areas. There was limited data for these topic areas published by Argentine authors. Radar Image Filtering appears to be one area of concentration that applies to this area of interest.

Authors:
Kaufmann-GH, Inst. de Fisica Rosario
Ramirez-Pastor, AJ, Univ Nacl San Luis
Muravchik-CH, Univ. Nacional de La Plata
Solsona-J, Nat. Univ. of Comahue
Valla-MI, Nat. Univ. of Comahue

Institutions:
Buenos Aires Univ.
Univ. Nacional de La Plata
Univ Nacl San Luis, San Luis
Univ Nacl Sur, Bahia Blanca
Ctr Atom Bariloche, Rio Negro

Brazil:

Leading country for these technology areas. This is probably due to the existence of an established university system and industrial complex. Their current economic woes not withstanding, Brazil is the most promising country for collaboration in Latin America in regards to these technology areas. Simulation & Modeling, Power Converters and MOSFET (semi-conductors) are the most widely published topics by Brazilian authors in these technology areas.

Authors:
Abdu-MA, Inst Nacl Pesquisas Espaciais
Takahashi-H, Inst Nacl Pesquisas Espaciais
Sobral, JHA, Inst Nacl Pesquisas Espaciais
Lima-AMN, Univ Fed Paraiba
Barbi-I, Pontificia Catolica Univ Parana

Institutions:
Univ Sao Paulo
Univ Fed Rio de Janeiro
Inst Nacl Pesquisas Espaciais, Sao Jose Dos Campos, SP
Fed Univ Florianopolis, Santa Catarina
Univ Fed Rio Grande Sul, Porto Alegre, RS

Chile:

Chile was the least prolific country for publishing papers related to these technologies when compared to the other three focus countries. There are potential political and economic reasons for this disparity. There is evidence of some power filter, network and computer science activity in Chile.

Authors:
Navarro-G, University Chile
Baeza-Yates-RA, University Chile
Goles-E, University Chile
Moran-LA, Concepcion Univ
Dixon-JW, Pontificia Univ Catolica Chile

Institutions:
University Chile, Santiago
Pontificia Univ. Catolica Chile, Santiago
Concepcion Univ, Concepcion
Univ Catolica Valparaiso, Valparaiso
Univ Catolic Norte, Coquimbo

Mexico:

Mexico has an established university system and industrial complex. There is some activity in these technology areas with the most notable being computer science. Mexico appears to have a well established university system and as noted in the literature (studies on the effects of

Maquiladora work), there is extensive cross border electronics commerce with the U.S.

Authors:
Estrada-M, IPN
Asomoza-R, IPN
Wang-H, Centro de Investigaciones Opticas
Sebastian-PJ, Univ Nacl Autonoma Mexico
Castano-VM, Univ Nacl Autonoma Mexico

Institutions:
IPN, (Nat. Polytechnic Inst), Mexico City
Univ Nacl Autonoma Mexico Mexico City
INAOE, Puebla, Mexico
Univ. Autonoma Metropolitana, Mexico City
Centro de Investigaciones Opticas, Leon

Recommendations

Brazil and Mexico research appears to be leading the other focus countries in the Electronics/Computer Science/Radar technology areas. Cooperative efforts outside these technology areas are more appropriate for the focus countries.

Underwater Acoustics

Approach

DIALOG Web was used to search for the terms "underwater sound", "sonar", and "ocean acoustic". INSPEC was chosen as it had the largest number of citations of all indicated DIALOG databases. Corporate sources were "Argentina", "Brazil", "Chile", and "Mexico". The years searched were 1979-2001.

Results

The results of the ocean acoustics analysis showed only 35 citations, and consequently a good analysis was not possible. Indications of research were obtained from the existing citations.

Argentina:
Authors:
Novarini- 5: Servicio Naval de Investigaciones y Desarrollo, Buenos Aires, underwater sound, scattering
Tacconi- 4: Universidad Nacional de La Plata, La Plata, sonar, acoustic signal processing
Bruno-2: Servicio Naval de Investigaciones y Desarrollo, Buenos Aires, underwater sound, scattering
Blanc-2: Servicio Naval de Investigaciones y Desarrollo, Buenos Aires, underwater sound, oceanographic techniques

Carasi-1: Universidad Nacional de La Plata, La Plata, sonar, acoustic signal processing

Institutions:
Universidad Nacional de La Plata - 5
Servicio Naval de Investigaciones y Desarrollo -4
Universidad de Buenos Aires -1
Puerto Belgrano Naval Base -1

Brazil:
Authors:
Carrion- 2: Campus University, Salvador, underwater sound, sonar, sediments
de Brito-1: Campus University, Salvador, underwater sound, oceanography
Machado-1: Petrobras, Rio de Janeiro, underwater sound, acoustic signal processing
Ramirez-1: Pontificas Universidade de Minas Gerais, Belo Horizonte, sonar
Silva-1:Petrobras, Rio de Janeiro, underwater sound, acoustic waveguides

Institutions:
PETROBRAS - 3;
Campus University - 2
Pontificas Universidade de Minas Gerais - 2
Universidade Federal de Bahia - 2
Universidade Federal Fluminense -1;

Chile:. NO RESULTS.

Mexico:
Authors:
Boumedine-2: Instituto Tecnologica y de Estudios Superiores de Monterrey, Monterrey, mobile
          robots, data acquisition
Dalle Molle-1: Instituto Tecnologica Autonoma de Mexico, Mexico City, underwater sound
Hinich-1: Instituto Tecnologica Autonoma de Mexico, Mexico City, underwater sound
Loske-1: Universidad Nacional Autonoma de Mexico, Mexico City, underwater sound,
          biomedical ultrasonics
Prieto-1: Universidad Nacional Autonoma de Mexico, Mexico City, underwater sound, shock
          waves

Institutions:
Instituto Tecnologica y de Estudios Superiores de Monterrey -2
Instituto Tecnologica Autonoma de Mexico - 2
Centro de Investigaciones Cientifica y de Educacion Superior de Ensenada - 2
Mayab AC -1
Universidad Nacional Autonoma de Mexico -1

Recommendations

Argentina had a presence in ocean acoustics, with thirteen publications. Strong institutions were Universidad Nacional de La Plata and Servicio Naval de Investigacion Desarrollo.
Brazil also had thirteen citations in ocean acoustics, with strong institutions including PETROBRAS, Universidade de Campus, Universidade Federale de Bahia, and Pontifical Universidade de Minas Gerais. Chile had no presence in ocean acoustics research. Mexico had nine citations within the institutes, Instituto Tecnologia y de Esudia Superiores de Monterrey, Instituto Tecnologia Autonoma de Mexico, and Centro de Investigaciones Cientifica de Educacion Superior de Ensenada, and Universidad Nacional Autonoma de Mexico.

Optics

Approach

DIALOG Web was used to search for the AIP classification code "A43-Optics". Corporate sources were "Argentina", "Brazil", "Chile", and "Mexico". INSPEC was chosen as it had the highest number of citations and its focus was in science and engineering. There were 1904 citations among the four countries. Argentina had 243: Brazil had 844: Chile had 28: Mexico had 789.

Results

Argentina:
Authors:
Bolognini-21: Universidad Nacional de La Plata, La Plata, interferometry, speckle
Depine-20: Universidad de Buenos Aires, gratings, edge effects
Kaufmann-17: Universidad Nacional Rosario, interferometry, image processing
Lehman-16: Universidad Nacional del Sur, Bahia Blanca, gratings, fractals
Garavaglia-15: Universidad Nacional de La Plata, La Plata, gratings, interferometry

Institutions:
Universidad de Buenos Aires - 77
Universidad Nacional de La Plata - 69
Universidad Nacional Rosario - 19
Universidad Nacional del Sur - 17
Centro Investigaciones Lasers Applicaciones - 6.

Brazil:
Authors:
de Araujo- 39: Universidade Federal de Pernambuco, Recife, optical materials, nonlinear optics
Baseia- 30: Universidad de Sao Paulo, Sao Paulo, quantum optics
Bagnato- 29: Universidad de Sao Paulo, Sao Paulo, optical cooling, trapping
Sombra- 29: Universidad Federal do Ceara, Ceara, fiber optics, dispersion
Messadeq- 28: Universidad de Sao Paulo, Sao Paulo, optical glass, optical harmonic generation

Institutions:
Universidade Estadual de Campinas - 153
Universidad de Sao Paulo - 150
Universidade Federal de Pernambuco -83
Universidade Federal de Rio de Janeiro - 49
Pontifica Universidade de Rio de Janeiro - 34;

Chile:
Authors:
Orszag-5: Pontifical Universidad Catolica de Chile, Santiago, quantum optics, cooling
Retamal- 4: Universidad Santiago de Chile, Santiago, quantum optics
Chuaqui- 3: Comision Chilena de Energia Nucleare, Santiago, interferometry, holography
Saavedra- 3:, Universidad de Concepcion, Santiago, quantum optics
Soto- 3: Comision Chilena de Energia Nucleare, Santiago, holography

Institutions:
Pontifical Universidad Catolica de Chile - 11
Comision Chilena de Energia Nucleare -4
European Southern Observatory - 3
Universidad de Concepcion - 3
Universidad Santiago de Chile -2.

Mexico:
Authors:
Starodumov- 37: Centro de Investigaciones en Optica, Leon, optical materials, fiber optics
Barmenkov- 27: Centro de Investigaciones en Optica, Leon, sensors, fiber optics
Servin- 26: Centro de Investigaciones en Optica, Leon, interferometry, image processing
Sanchez-Mondragon- 25:Instituto Nacional de Astrofisica, Optica, y Electronica, Puebla, optical
        materials
Korneev- 24: :Instituto Nacional de Astrofisica, Optica, y Electronica, Puebla, optical materials,
        gratings

Institutions:
Centro de Investigaciones en Optica -213
Instituto de Investigaciones en Optica - 133
Universidad Nacional Autonoma de Mexico - 126
Centro de Investigaciones Cientifica y de Educacion Superior de Ensenada - 77
Universidad Autonoma de Puebla - 64

Recommendations

Argentina:
Strengths in interferometry, gratings, Fourier optics. Universidad de Buenos Aires and
Universidad Nacional de La Plata.

Brazil:
Strengths in optical materials, nonlinear optics, laser cooling, optical glass. Universidade Estadual de Campinas, Universidade de Sao Paulo, and Universidade Federal de Pernambuco.

Chile:
Strengths in quantum optics, laser cooling, interferometry. Pontificia Universidad Catolica de Chile

Mexico:
Strengths in fiber optics, interferometry, image processing. Centro de Investigaciones en Optica, INAOE, Universidad Nacional Autonoma de Mexico, Centro de Investigaciones Cientifica y de Educacion Superior de Ensenada, Universidad Autonoma de Puebla.

Manufacturing

Approach

The manufacturing capability in the countries of Argentina, Brazil, Chile, and Mexico was investigated by analyzing citation information from the INSPEC, SCI and EI-Compendex databases. The following key words were used: Manufacturing, Composite Material, Embedded Sensor, Ship, MEMS, Wide-Band Gap Semiconductor. Final results were achieved by manual review of specific article content. Authors and institutions were ranked by number of publications with the number of publications listed next to the specific author and institution.

Results

By far, the keywords that produced the majority of the papers captured here were centered on composite materials technology. There were 499 citations among the four countries. Argentina had 67: Brazil had 316: Chile had 30: Mexico had 86. The top authors and institutions that were identified are:

Argentina:
Authors:
Reboredo - 4: Univ.Nac. Mar de Plata, composite materials, molding
Williams- 4: Univ.Nac. Mar de Plata, chemical manufacturing, fibers
Da Silveira- 2: IAE Univ. Astral, Buenos Aires, customer-driven manufacturing
Marinez-Ingar- 2: Inst. Desarrollo & Diseno, Sante Fe, process management, modeling
Apostoli- 1: Univ. Tech. Nac., Cordova, robotics control systems, flexible manufacturing

Institutions:
Universidad Nacional De Mar Del Plata, Mar Del Plata- 6
CONICET,Natl Council Sci & Technol Res,La Plata, Buenos Aires- 2
Ingar Inst Desarrollo & Diseno, Santa Fe- 2
Univ Austral, IAE, Buenos Aires- 2
Universidad Tecnologica Nacional, San Nicolas- 1

Brazil:
Authors:
Borenstein- 4: Univ. Fed.Rio Grande, do Sul, Porto Alegre, flexible manufacturing
Perkusich- 3: Univ. Fed. Paraiba, Campina Grande, modeling
Rozenfeld- 3: Univ. Sao Paulo, computer integrated manufacturing, automation,
Arata- 2: Univ. Sao Paulo, simulation
Camargo- 2: Univ. Fed Sao Carlos, flexible manufacturing

Institutions:
Universidade Federal de Sao Carlos, Sao Carlos- 4
Universidade Federal do Rio Grande do Sul, Porto Alegre- 4
Univ of Sao Paulo, Sao Paulo- 2
Universidade Federal da Paraiba, Campina Grande- 2
Dept. de Engenharia Mecanica-Mecatronica, Sao Paulo Univ.- 1

Chile:
Authors:
Garin- 4: Univ. Santiago, powdered metals processing
Cabezas- 3: Pontifica Univ. Catolica, Santiago, sensors, paper manufacturing
Arauco- 1: Pontifica Univ. Catolica, Santiago, metals processing
Cordova- 1: Univ. Santiago, manufacturing management
Cusumano- 1: Univ. Adolfo Ibanez, Vina del Mar, semiconductor packaging

Institutions:
Universidad de Santiago de Chile, Santiago, Chile- 4
Pontificia Univ Catolica, Casilla, Correo, Santiago, Chile- 1
Universidad Adolfo Ibanez, Vina del Mar, Chile- 1

Mexico:
Authors:
Lopez-Mallado- 3: Univ. Autonoma, Nuevo Leon, modeling
Sanchez- 2: Inst. Technol.& Estudios Super Monterrey, artificial intelligence
Aguirre- 1: Univ. Pan Americana, control systems
Arjona- 1: Suarez- Colegio de Postgraduados, Montecillo, control engineering
Borja- 1: Univ. Nacl. Autonoma, Mexico City, reverse engineering

Institutions:
Inst Tecnol & Estudios Super Monterrey, Ctr Inteligencia Artificial/Monterrey, Nuevo Leon- 2
Univ Autonoma Nuevo Leon, Fac Ciencias Fisicomatemat, Ciudad Univ, San Nicolas Garza- 2
Colegio De Postgraduados, Montecillo- 1
Inst Socioecon Estadist & Informat, Colegio Postgrad, Montecillo- 1
Inst Tecnol & Estudios Super Monterrey, Monterrey- 1

Recommendations

Argentina:
Chemical Products/Plastics & Polymeric Materials
Universidad Nacional de Mar del Plata, Mar del Plata

Brazil:
Production Control/Statistical Methods/Expert Systems/Flexible Manufacturing Systems
Universidade Federal de Sao Carlos, Sao Carlos
Universidade Federal do Rio Grande do Sul, Porto Alegre

Chile:
Automatic Control/Production Planning & Control/Metallurgical Engineering
Universidad de Santiago de Chile, Santiago

Mexico:
Artificial Intelligence/Automated Manufacturing Systems/Simulation
Inst Tecnol & Estudios Super Monterrey, Ctr Inteligencia Artificial, Monterrey, Nuevo Leon
Univ Autonoma Nuevo Leon, Fac Ciencias Fisicomatemat, Ciudad Univ, San Nicolas Garza

Oceanography

Approach

For Oceanography, the SCI database provided the best coverage of the subject area. Keywords included 'oceanography', 'marine', 'coastal', 'littoral', and 'underwater', and only literature since 1997 was used. The large quantities of fisheries and biology research were then removed manually before downloading the final set of 337 records. Finally, 44 records found in the INSPEC database were added. There was no overlap between the two datasets and only in Brazil did the INSPEC database yield a top author.

Results

Due to database coverage, two topics dominated the research in all of the target countries: paleo-geology (studying land formation) and environmental monitoring (primarily pollution and sedimentation from river mouths). Other highlights from each country are listed below.

Argentina:
Argentina accounted for 68 of the 381 records. The top authors from Argentina are:

Villalba, R (4 pubs/15 cites) - CRICYT, Mendoza: Tree-ring climate estimates
Iriondo, MH (3 pubs/7 cites) - CONICET, Buenos Aires: Land formation, paleo-geology
Kandus, P & Karszenbaum, H (3 pubs/1 cites) - CONICET, Buenos Aires: Land classification
　　using SAR imagery

Matano, RP & Palma, ED (3 pubs/11 cites) - Univ Nacl del Sur, Buenos Aires: Complex current flow modeling

Also of note, a lab at Buenos Aires Univ, was studying using stereoscopic vision in AUVs. In a creative combination of zoology and oceanography, a group a the Centro Nacional Patagonico tagged a group of elephant seals with data loggers to get several months worth of depth/temperature data over a large region of the south Atlantic.

Brazil:
Brazil accounted for 109 of the 381 records. The top authors from Brazil are:

Donha, DC; Desanj, DS;& Katebi, MR (5 pubs/ND cites) - Univ Sao Paulo: Dynamic positioning of a "turret moored floating production storage and off-loading system."
Costa, RR; Lizarralde, F; DaCunha, JPVS; & Liu Hsu (4 pubs/0 cites) - Univ Fed Rio de Janeiro: Dynamic positioning of ROVs
Dominguez, JML (3 pubs/1 cites) - Univ Fed Bahia, Salvador: Tidal currents, sedimentation
Soares-Filho-W (3 pubs/ND cites) - Brazilian Navy Res. Inst., Rio de Janeiro: Ship classification using passive sonar

Chile:
Chile accounted for 59 of the 381 records. Several research groups in Chile are studying the upwelling system off Chile's coast. There are also several articles studying the El Nino phenomenon. The top authors from Chile are:

Rutllant, J (4 pubs/23 cites) - Univ Chile, Santiago: Air-sea interface and meteorology
Blanco, JL (3 pubs/0 cites) - Inst Fomento Pesquero IFOP, Valparaiso: Ocean chemistry in upwellings
Ortlieb, L (3 pubs/7 cites) - Univ Chile, Santiago: Coastal paleo-geology
Pizarro, O (3 pubs/27 cites) - Concepcion Univ: Ocean circulation and currents

Mexico:
Mexico accounted for 145 of the 381 records. Research studying sedimentation and heavy metal pollution was especially common. The top authors from Mexico are:

Castro, P (5 pubs/7 cites) - Inst Politecn Nacl, Merida: Concrete corrosion in marine environments
Filonov, AE (5 pubs/2 cites) - Univ Guadalajara: Internal waves, effects on temperature and salinity
Paez-Osuna, F (5 pubs/5 cites) - Univ Nacl Autonoma Mexico, Inst Ciencias Mar & Limnol, Mazatlan: Heavy metals pollution
Veleva, L (5 pubs/11 cites) - Inst Politecn Nacl, Merida: Atmospheric corrosion of metals in marine environments

Also of note, a group at CICESE is studying surface waves with SAR imaging.

Recommendations

Anyone studying the geology, ocean chemistry, pollution, or currents off the coast of South America can easily find local experts with data. Offshore oil exploration has also encouraged several smaller research groups studying marine control systems in Brazil. UNAM's Institute of Ocean Sciences in Mazatlan has a strong program on corrosion in marine environments.

Lessons Learned

The magnitude of this project was unprecedented in data mining support provided by Naval Reservists. Members of the team were experienced with data mining techniques from individual past smaller projects. Since many of the team members were scattered across the country, use of teleconferences for coordination and extensive use of electronic file transfer methods were critical during the data analysis and results integration process. The following lessons learned were captured during the course of this project and are offered as guidance to subsequent team data mining efforts of this magnitude.

- The choice of key words is critical in effectively analyzing a broad technology area.
- For broad categories like Material Science and Bioscience, multiple database searches may be necessary to identify all significant capability.
- INSPEC Classification codes are good for limiting broad searches, although the INSPEC database is somewhat more narrowly focused.
- Care must be taken to eliminate references from "New Mexico" which can be significant (UNM, Sandia, LANL).
- Institutions use multiple names for the same place.
- CIO accounted for 56 of the 346 institutional affiliations in the Mexico optics search.
- Overlaps between INSPEC and SCI databases were observed in some cases. Reasonable for material science (many overlaps in top authors). Poor for bioscience.
- Different databases offer different areas of coverage. Care must be taken to select the optimum database for the area analyzed.
- Many of the researchers had publications in very good journals, such as JOSA, Optical Engineering, Optics Letters, JASA.
- SCI is the only database used that includes citation information.
- The DIALOG Science Citation Index database does <u>NOT</u> provide author citation data. Recommend use of databases through the Naval Research Laboratory library.
- Different focus areas defined "citations" differently.
- Always perform a hand-check review of a selected sampling of references to validate sources. Care must be taken to check and eliminate references extracted from conference proceedings (major contributing authors may not be from S/LA).
- "Self-citations" are not easily removed from citation data in the Science Citation Index database.
- Selection is important: Even highest numbers of citations may not be the best choice, as the focus of the journals may not be strictly S&T.

- In doing citation searches on common names (e.g., Garcia), care must be taken to ensure only citations to the correct author are counted. This required time consuming hand checking.
- Coordination of all team members was successfully accomplished using scheduled teleconferences and extensive usage of electronic mail and file transfer protocols. Use of "master" document templates is strongly advised to assist team members to produce final documents of consistent format and content.